

Manufacturing Jobs Continued to Shift to Nonmetro Areas in 1993

Lower labor costs are probably one of the reasons for the stability of nonmetro manufacturing jobs while metro manufacturing jobs decrease. Manufacturing wages in nonmetro plants are 25 percent lower than metro wages, and nonmetro output per worker is 23 percent lower. However, a comparison of technology use in five technology-intensive industries shows little metro-nonmetro difference.

The nonmetro share of manufacturing employment rose steadily from 20 to 23 percent during 1985-93. Metro manufacturing jobs declined in all but 1 year over that period, while nonmetro manufacturing employment grew or remained stable in each year except the 1990-91 recession period. From 1992 to 1993 (the most recent years for which metro-nonmetro data are available), nonmetro areas added 90,000 manufacturing jobs, while metro areas lost 61,000. Nearly all of the nonmetro manufacturing job growth was in three regions: the Southeast, Great Lakes, and Plains. The nonmetro Southwest and Rocky Mountain regions added 7,000 manufacturing jobs each, while the New England, Mideast, and Far West experienced small job losses. Manufacturing is an important source of employment for nonmetro economies, accounting for 16.8 percent of jobs. The Southwest, Rocky Mountain, and Far West nonmetro regions are least dependent on manufacturing, while manufacturing dependence is highest in the Southeast and Great Lakes nonmetro regions.

National employment data for 1995 suggest that the rise in nonmetro share of manufacturing employment may have slowed during 1995, as most rural-oriented industries lost jobs or grew slowly. Employment in textiles and apparel fell 7 percent and 2.5 percent, respectively, and employment fell less than 1 percent in the furniture and paper products industries. Jobs in food processing and lumber and wood products grew by less than 1 percent in 1995. Most manufacturing job growth in 1995 was in fabricated metal products, industrial machinery and equipment, and electronic equipment. These industries are largely urbanized, but still account for about 20 percent of nonmetro manufacturing jobs.

Nonmetro Manufacturers Lag in Wages and Productivity

Manufacturing firms are often attracted to nonmetro locations by proximity to raw materials, a more hospitable regulatory environment, and cost advantages. As a result, nonmetro manufacturing has been concentrated in mature low-wage, labor-intensive manufacturing industries with standardized production processes. The labor cost advantage of nonmetro areas is evident in a comparison of nonmetro and metro manufacturing salary and wages per worker from the 1992 Census of Manufactures, which shows that nonmetro wages averaged only 75 percent of metro wages. Three of 20 major industries had nonmetro-metro wage ratios of less than 70 percent, four had ratios of 70-79 percent, and six had ratios of 80-89 percent. Only the paper and allied products industry paid higher average wages in nonmetro plants than in metro plants, and the ratio of nonmetro to metro wages was 90 percent or more in lumber and wood products (97 percent), textile mill products (95 percent), rubber and miscellaneous plastic products (94 percent), stone, clay, and glass (91 percent), and primary metal industries (90 percent). Wages are lowest in apparel and leather products industries (under \$15,000 per worker), and highest in petroleum and coal products (\$37,300), paper (\$35,500), and chemicals industries (\$34,500).

Lower nonmetro average wages can be attributed to several factors, including a nonmetro industry mix more heavily concentrated in low-wage/low-productivity industries, concentration of nonproduction workers such as office workers, (who usually have higher wages) in metro areas, and generally lower labor costs in rural areas. Labor productivity, considered by economists to be a key determinant of wages, is lower in nonmetro manufacturing plants, but this seems to explain only part of the difference in wages. On average, manufacturing value-added per nonmetro worker is only 77 percent of value-added per metro worker, just 2 percentage points higher than the ratio of nonmetro to metro wages. However, when nonmetro and metro plants in the same industry are compared, a brighter picture of nonmetro productivity emerges. Nonmetro value-added per worker exceeds metro values in five major industries—textile mill products, lumber and wood products,

paper and allied products, rubber and miscellaneous plastics, and miscellaneous manufacturing industries. Seven other industries have nonmetro-metro productivity ratios of 90 to 99 percent. Six industries have nonmetro-metro productivity ratios of 80-89 percent, and only three industries have ratios less than 80 percent.

The ratio of overall nonmetro to metro productivity is lower than individual industry comparisons due to concentration of low-productivity industries in nonmetro counties. For example, the textile, apparel, lumber and wood products, and furniture industries, with relatively low productivity, make up nearly 30 percent of nonmetro manufacturing employment, but only 12 percent of metro manufacturing employment. When average nonmetro value-added per worker is computed using the metro distribution of employment by industry, the nonmetro-metro productivity ratio rises from 77 to 85 percent. Thus, lower overall average nonmetro productivity is due to a combination of the nonmetro industry mix and generally lower productivity of nonmetro plants compared with metro plants in the same industry.

Manufacturing employment in nonmetro and metro counties, 1993

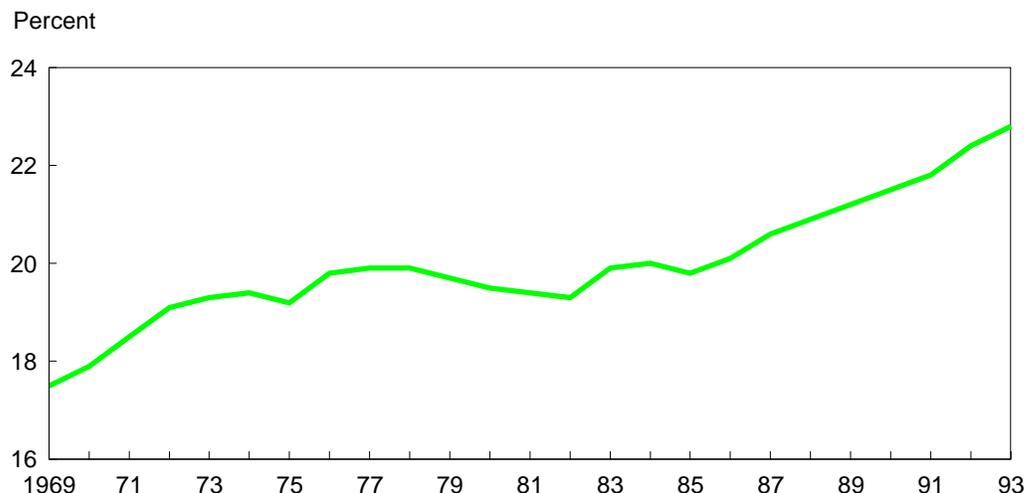
Most nonmetro manufacturing job growth was in the Great Lakes, Plains, and Southeast regions

| Region | Manufacturing employment 1992-93 | | Growth | |
|----------------|----------------------------------|--------|----------|-------|
| | Nonmetro | Metro | Nonmetro | Metro |
| Thousands | | | | |
| All regions | 4,274 | 14,463 | 90 | -61 |
| New England | 162 | 948 | -1 | -24 |
| Midwest | 285 | 2,499 | -3 | -53 |
| Great Lakes | 861 | 3,325 | 26 | 22 |
| Plains | 544 | 898 | 21 | 2 |
| Southeast | 1,894 | 2,884 | 35 | 35 |
| Southwest | 223 | 1,219 | 7 | 24 |
| Rocky Mountain | 121 | 308 | 7 | 7 |
| Far West | 184 | 2,380 | -2 | -74 |

Source: Calculated by ERS using data from the Bureau of Economic Analysis.

Nonmetro share of manufacturing employment, 1969-93

Manufacturing jobs shifted to nonmetro areas from 1985 to 1993



Source: Calculated by ERS using data from the Bureau of Economic Analysis.

Nonmetro Plants Keep Pace in Technology Use

Use of advanced technology boosts manufacturing productivity and competitiveness by reducing labor costs, increasing worker productivity and product quality, and increasing flexibility and responsiveness to market changes. By making workers more productive and increasing the complexity of manufacturing jobs, technology use can also lead to higher wages for manufacturing workers. Some observers are concerned that rural manufacturers may fall behind their urban counterparts in use of advanced technology. ERS analyzed technology use in six manufacturing industries surveyed by the Census Bureau (see box). In these technology-intensive industries representing a third of nonmetro manufacturing employment we find little difference in technology use between metro and nonmetro manufacturers. In fact, rural firms lead metro firms in adoption of four out of five fabrication/machining and assembly technologies, including flexible manufacturing cells or systems, numerically controlled machines, and robot use, and in the use of several communication and control technologies. Use of computer-aided design and engineering (CAD/CAE) by nonmetro manufacturers in the selected industries increased rapidly from 45 percent in 1988 to 68 percent in 1993, about the same percentage of use reported by metro manufacturers. CAD/CAE was the technology whose use was reported most often by both metro and nonmetro plants, followed by numerically controlled machines at nearly

Comparison of metro and nonmetro labor productivity and wages, 1992

Labor productivity and salaries and wages are lower in nonmetro manufacturing establishments than in their metro counterparts

| Standard industrial code | Industry | Share of nonmetro manufacturing employment | Value-added per worker | | Average annual salary and wages per worker | |
|--------------------------|---|--|------------------------|----------------------------|--|----------------------------|
| | | | Nonmetro average | Ratio of nonmetro to metro | Nonmetro average | Ratio of nonmetro to metro |
| | | Percent | \$1,000 | Percent | \$1,000 | Percent |
| 20 | Food and kindred products | 11.8 | 74.5 | 64 | 20.1 | 76 |
| 21 | Tobacco products | .1 | 337.3 | 44 | 27.3 | 65 |
| 22 | Textile mill products | 7.4 | 49.5 | 104 | 19.6 | 95 |
| 23 | Apparel and other textile products | 9.2 | 32.1 | 81 | 13.5 | 80 |
| 24 | Lumber and wood products | 9.5 | 52.6 | 109 | 20.9 | 97 |
| 25 | Furniture and fixtures | 3.7 | 45.3 | 91 | 19.5 | 87 |
| 26 | Paper and allied products | 4.7 | 110.1 | 122 | 35.5 | 113 |
| 27 | Printing and publishing | 5.1 | 55.1 | 70 | 19.8 | 69 |
| 28 | Chemicals and allied products | 3.2 | 175.8 | 90 | 34.5 | 89 |
| 29 | Petroleum and coal products | .4 | 177.9 | 84 | 37.3 | 84 |
| 30 | Rubber and miscellaneous plastic products | 5.8 | 65.8 | 103 | 24.2 | 94 |
| 31 | Leather and leather products | 1.0 | 41.6 | 89 | 14.8 | 75 |
| 32 | Stone, clay, and glass products | 3.2 | 73.0 | 99 | 26.1 | 91 |
| 33 | Primary metal industries | 3.4 | 72.7 | 91 | 30.8 | 90 |
| 34 | Fabricated metal products | 6.5 | 60.9 | 99 | 25.2 | 86 |
| 35 | Industrial machinery and equipment | 8.9 | 66.3 | 85 | 27.2 | 79 |
| 36 | Electronic and other elect. equipment | 6.5 | 71.0 | 82 | 23.7 | 73 |
| 37 | Transportation equipment | 5.9 | 82.3 | 82 | 27.2 | 69 |
| 38 | Instruments and related products | 1.9 | 89.9 | 90 | 26.6 | 72 |
| 39 | Miscellaneous manufacturing | 1.7 | 61.2 | 102 | 20.3 | 86 |
| NA | All manufacturing | 100.0 | 68.1 | 77 | 23.3 | 75 |
| NA | Average using metro employment shares as weights ¹ | 100.0 | 75.4 | 85 | 24.7 | 80 |

¹This computation shows what average nonmetro value-added and wages would be if nonmetro areas had the same mix of employment by industry as that of metro areas.

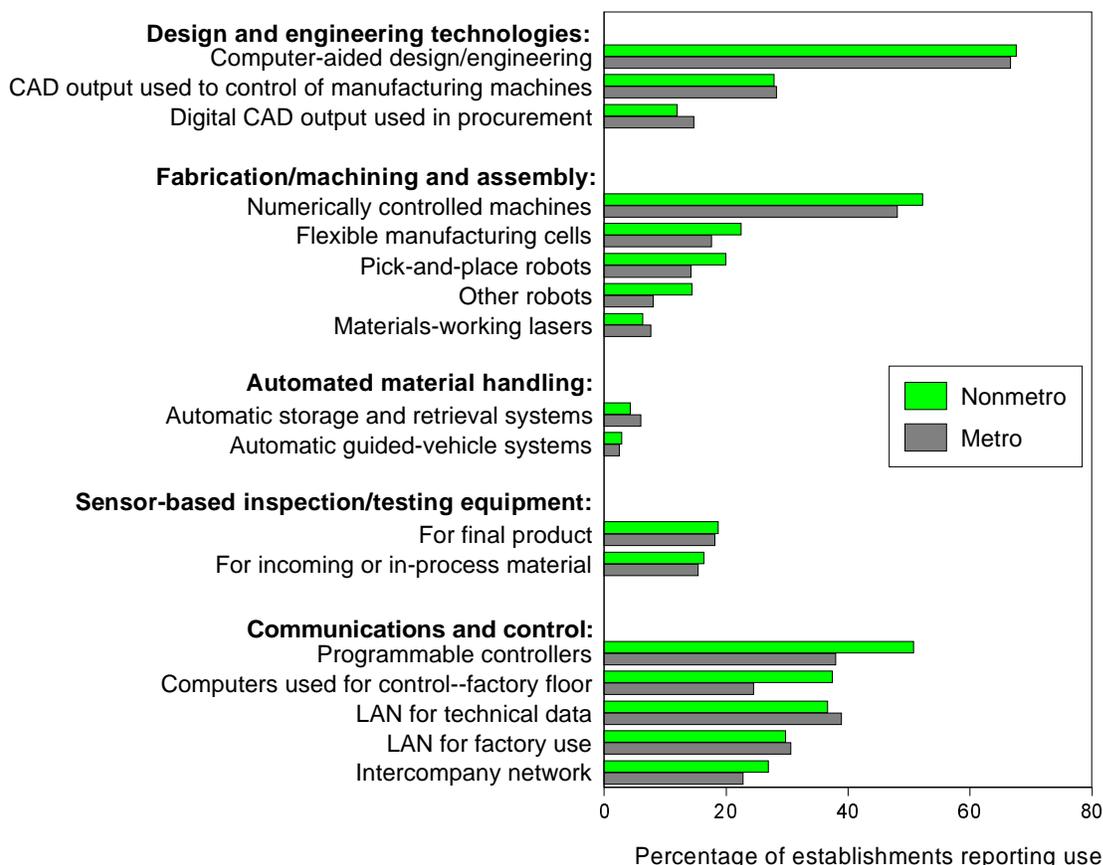
Source: ERS analysis of special tabulations by the Census Bureau from the 1992 Annual Survey of Manufacturing.

60 percent. Nonmetro plants in the selected industries were slightly behind metro plants in use of automated storage and retrieval systems in both 1988 and 1993, but were even with metro firms in use of automated guided vehicle systems and automated sensor-based inspection and testing equipment.

Nonmetro plants report plans for adoption and use of technology that will keep them abreast of metro plants in the selected industries in coming years. A larger percentage of rural than urban plants reported plans to add CAD/CAE, materials-working lasers, robots, guided vehicle systems, and intercompany computer network technologies in the following 5 years. The technology most often included in plans for adoption was intercompany computer networks, which nearly 13 percent of nonmetro manufacturers said they planned to acquire within 5 years. The second most popular new technology was the use of CAD output to control manufacturing machines, which nearly 11 percent of nonmetro plants planned to implement.

Technology use by metro and nonmetro manufacturing establishments, selected industries, 1993

Nonmetro manufacturers' use of technology equals or exceeds use by metro plants



Note: Data are a sample of establishments from five manufacturing industries (see accompanying box).
 Source: ERS analysis of *Survey of Manufacturing Technology* data provided by U.S. Bureau of the Census.

Cost Is the Biggest Barrier to Adoption

There is some concern that rural manufacturers may be at a disadvantage in finding out about and implementing new technologies, due to their relative isolation and the lower education and/or skill levels of rural workers. However, the 1991 Census Bureau survey of the selected industries suggests that these factors play a minor role in slowing adoption by nonmetro plants, while costs seem to be the dominant barrier. Cost of equipment was identified most often as a barrier to adoption by both metro and nonmetro plants, followed by cost of software. Cost of equipment was identified by 38.6 percent of nonmetro plants surveyed as a barrier to adoption of fabrication and/or machining technologies. For design/engineering, materials handling, and inspection/quality control technologies, cost of equipment was reported as a barrier by about 30 percent of nonmetro plants. The share of nonmetro plants identifying software cost as a barrier ranged from 12.5 percent for materials-handling technologies to 19.0 percent for design and engineering. Cost of education and training was identified as a barrier to use of materials handling technologies by only 7.8 percent plants, and between 10 and 12 percent for other technology categories. The share of nonmetro plants reporting lack of skilled work force as a barrier ranged from 5.6 percent for materials-handling technologies to 12.5 percent for fabrication and/or machining. There was no significant difference between metro and nonmetro plants in the selected industries in the importance of cost of education and training, but lack of skilled work force was reported more frequently as a barrier by nonmetro manufacturers than metro manufacturers. Information-related barriers seem to be more common for nonmetro manufacturers, but were identified as a barrier by fewer than 5 percent of respondents. Lack of information on technology was reported by a significantly greater percentage of rural plants than urban in three of the four technology areas. Lack of technical support from vendors is another minor barrier that is more important for nonmetro firms.

Manufacturers Like Quality Improvement Resulting from Advanced Technology

For three of the four groups of technology types, quality improvement was the most-often-identified benefit of new technologies by both metro and nonmetro plants in the selected industries, followed by labor cost reduction. These two benefits were reversed in importance for materials-handling technologies. The most noticeable metro-nonmetro differences were for fabrication/machining technologies. Nonmetro plants reported quality improvement, labor cost reduction, flexibility increase, setup time reduction, and inventory reduction as important benefits more often than metro plants.

The results of these surveys are of limited value, because they cover only a fraction of nonmetro manufacturers, but they do seem to argue strongly against nonmetro technology adoption barriers as an explanation for lower nonmetro productivity in the selected industries. Technology usage does not appear to explain the differential in nonmetro vs. metro productivity for the industries covered by this survey. Nonmetro value-added per worker was 82 percent of metro value-added per worker for transportation equipment and electronic and other electric equipment, 85 percent for industrial machinery, and 90 percent for instruments and related products, while nonmetro and metro worker productivity were equal in the fabricated metal products industry.

Communications Technologies Reduce Isolation of Rural Manufacturing Plants

Rural manufacturing is composed largely of mature industries with standardized, labor-intensive production processes, while newer, innovative industries are concentrated in urban areas where access to information and markets is greater. The nonmetro industry mix could change, however, as new telecommunications and information technologies improve the flow of information to rural areas. This would reduce the isolation of nonmetro locations, allowing them to compete with metro areas for a greater range of manufacturing activities, including more of the newer innovative and complex processes that often provide jobs with higher skill demands and higher pay.

New production practices like “flexible manufacturing” or “just-in-time” processes favor the clustering of related manufacturing operations, often in metro locations, but also may strengthen the competitive position of nonmetro manufacturers relative to foreign locations. In flexible manufacturing processes, proximity to suppliers is often important because of the cost savings accrued from inventory reduction and decreased delivery charges. Being close to major suppliers also can enhance cooperative efforts. However, the changing economics in freight handling and improvements in communication technologies will reduce the costs of communication and shipping of parts and materials to and from nonmetro plants.

Trade liberalization through NAFTA, GATT, or other means erodes the cost advantage enjoyed by nonmetro areas in labor-intensive industries like apparel and shoe manufacturing that have been an important component of rural manufacturing, by exposing them to additional competition from Pacific Rim and Latin American countries with even lower costs. On the other hand, nonmetro U.S. locations are becoming more attractive to manufacturers from high-wage countries. We have already seen Japanese and German firms building new plants in U.S. rural locales to take advantage of lower wage rates and other costs, and to gain access to the North American market. Additionally, markets for products that make intensive use of raw materials in which the United States may have a cost advantage, such as food and forest products, may be expanded by liberalized trade. [*Fred Gale, 202-219-0594, fgale@econ.ag.gov*]

Surveys of Manufacturing Technology Provide Valuable Information on Technology Adoption in Selected Industries

The Survey of Manufacturing Technology (SMT) in 1988 and 1993 covered five major manufacturing groups (SIC codes 34-38): Fabricated Metal Products, Industrial Machinery and Equipment, Electronic and Other Electric Equipment, Transportation Equipment, and Instruments and Related Products. These industries are predominantly urban. In 1992, they accounted for 30 percent of nonmetro and 45 percent of metro manufacturing employment. The survey results are nevertheless helpful in identifying possible nonmetro-metro differences in technology adoption.

The use of 17 advanced technologies, organized into five general areas, was measured with the survey:

- Design and engineering (computer-aided design/engineering (CAD/CAE))
- Fabrication/machining and assembly
- Automated material handling
- Automated sensor-based inspection and/or testing
- Communication and control

The 1991 SMT asked manufacturing establishments to identify their three most important barriers to adoption of four broad groups of advanced technologies: design/engineering, fabrication/machining, materials handling, and inspection/quality control.